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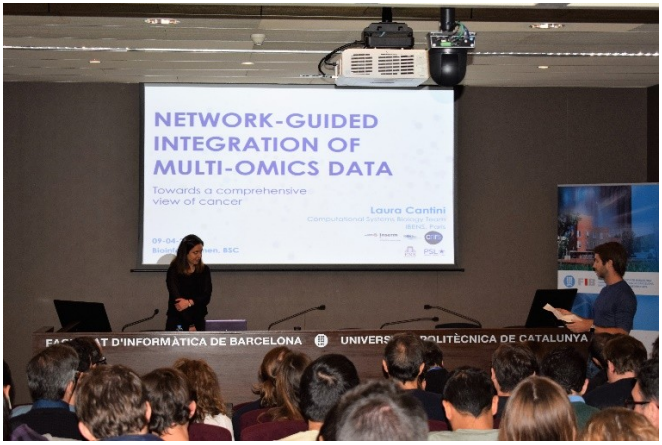
Network-guided integration of multi-omics data: towards a comprehensive view of cancer

Laura Cantini
IBENS France

This seminar was part of the BioInfo4Women series.

Abstract
Cancer is a global health issue with a mortality rate that is expected to rise by about 70% over the next 2 decades (World Health Organization). Despite the significant breakthroughs in its understanding, prevention, and treatment, cancer's complexity slows the quest for its cure. The advent of high-throughput technologies has provided the possibility to gather a comprehensive molecular picture of this disease by allowing the detailed characterization of thousands of tumors at multiple molecular levels ("multi-omics"). The current main challenge is to translate this wealth of information into actionable knowledge about the pathogenesis of this disease.



In this talk I will give three examples of how the integration of multiple omics data can reveal new insights about cancer. First, I will show that combining microRNA and mRNA expression data we can identify new regulatory mechanisms underlying colorectal cancer subtypes. Second, I will prove that multiplex networks, a trending topic in network theory, are very well suited for the joint integration of multi-omics data. Third, I will show that by combining the results of matrix factorization across 14 independent transcriptomic datasets we can reconstruct the landscape of those pathways involved in the the different subtypes of colorectal cancer.

Short bio

The research interests of Laura Cantini are in the field of cancer systems biology. She obtained her BS and MS in applied mathematics from the University of Florence. Interested in cancer complexity and wishful to work on real patient-derived data, She pursued a PhD in Systems Biology at the University of Turin, at the interface between different disciplines: oncology, physics and computer science. During her PhD, she moved for 6 months to Aalto University (Finland) to acquire new competences in network theory and to apply the multiplex framework for multi-omics data integration. In January 2016, she joined the Cancer Computational and Systems Biology group at Institut Curie as a postdoc. She is one of the L'Oréal- UNESCO for Women in Science fellows of 2018. From November 2018 she has been recruited as CNRS Research Scientist (Chargé de Recherches) at IBENS, specialized in multi-omics data integration in cancer.